Review of the State Water Resources Control Board's Report on the Agricultural Economic Effects of River Flow Alternatives on the Lower San Joaquin River (Appendix G)

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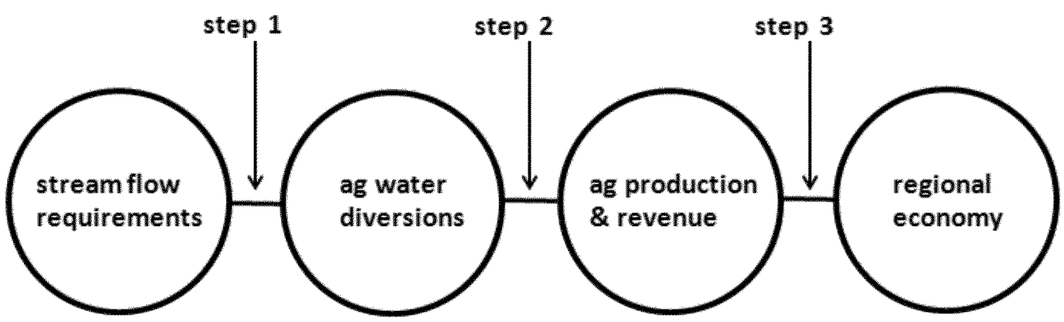
Background

The State Water Resources Control Board has released a public draft of report entitled *Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality*, which is dated December 2012. Appendix G is entitled *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*. It focuses on the FERC relicensing of the New Don Pedro project and its impacts on the Lower San Joaquin River (LSJR). This report was prepared by both Water Board staff (Mark Gowdy) and outside consultants (Russ Brown of ICF International, and Richard Howitt and Josué Medellín-Azuara of UC Davis).

The report specifically focuses on agricultural production, and its economic value and significance, in areas that rely on water from the Stanislaus, Tuolumne, and Merced Rivers. The report examines the impact on agriculture of the following river flow requirements: 20%, 40%, and 60% of unimpaired flow during the months of February thru June. The higher the flow requirement (e.g. 60% of unimpaired flow), the less water is available for agriculture. The effects on hydropower are covered in a separate report, but are minor compared to the effects on agriculture.

The report goes through several modeling steps, presenting results at each level.



1. The effects of the flow requirements on agricultural water diversions are modeled. This is done using a Water Supply Effects (WSE) model, a water balance spreadsheet, for each of the rivers and considering each major reservoir (New Melones, New Don Pedro, and Lake McClure). It is subject to various constraints associated with flood control trigger levels associated with releases from reservoirs. This modeling effort assumes the status quo flood control requirements and does not explore changes to those.

2. The effects of the altered water diversions on agricultural production are modeled. This modeling effort uses the results of Step 1 above in a Statewide Agricultural Production

(SWAP) model to estimate changes in agricultural production (in terms of acres planted) and revenues as a result of decreased water availability. This modeling effort assumes that ag producers do *not* pump extra ground water to make up for lost surface water deliveries.

3. The effects of the decreased agricultural production on the regional economy are modeled. This effort uses the results of Step 2 above in an Impact Analysis for Planning (IMPLAN) model.

The report is relatively straight-forward and easy to understand. It is impossible, however, to validate the results of the various models, as they are complicated and no details allowing model replication are provided. However, I was able to discuss the models with the consultants at a public meeting on March 20, 2012.

I summarize the results and provide some additional perspective.

Summary of Results

STEP 1: AG WATER DIVERSIONS
Because there are dry years and wet years, the results are presented in terms of probabilities. For example, 70% of the time, this specified level of effect can be expected. In reading the graph below (taken from their report), each dot represents one of 82 water years modeled. Wet years are on the left, dry years are on the right.

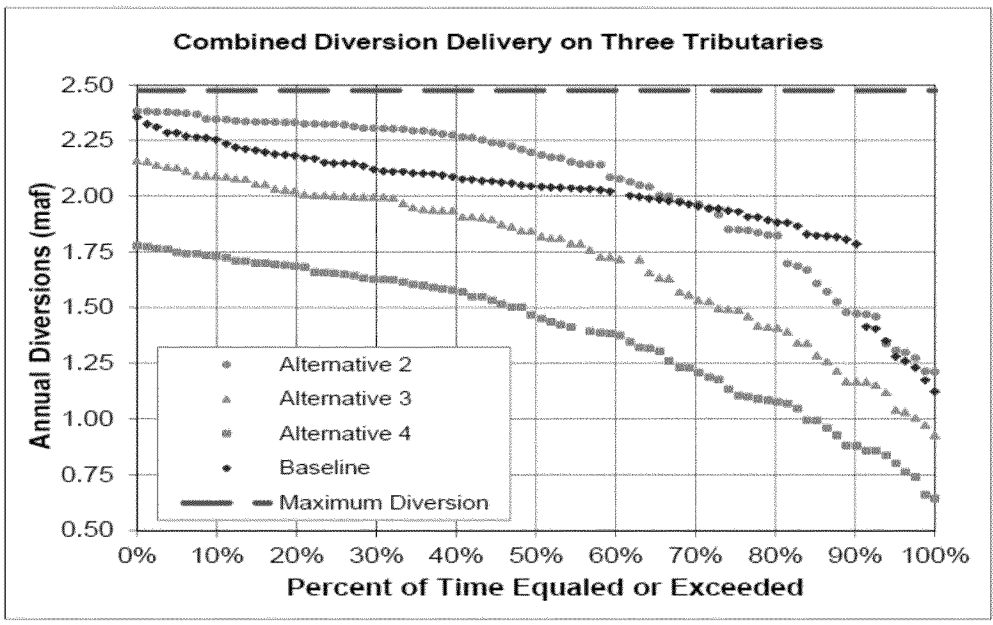


Figure G-1. Exceedance Plot of WSE Estimates for Total LSJR Watershed Annual Surface Water Diversions for the LSJR Alternatives and Baseline across the 82 Years of Simulation

Note that the dark blue is baseline—so the 20% regime (Alternative 2) actually results in more water available for ag diversions. This implies the current flow requirement is about 30% of unimpaired flow (on average, depending on the water year).

STEP 2: AG PRODUCTION

Under most scenarios, changes in total ag production and revenues are large in absolute terms (e.g. $50 million losses), but small in relative terms (e.g. a 2% decrease). I have compared the model results to recent ag data from Stanislaus County, which encompasses most of the impacted area. I have also compared the data to Merced County.

As with water deliveries, the report presents changes in ag production in terms of probabilities. The report also presents data in terms of expected effects on specific crops. The model assumes that fewer acres are planted if less water is available, beginning with the lowest value crops first. Crops for silage for dairy, however, are constrained in the model to provide for all the necessary feed for cows. Though rare, the model allows farmers to shift among some crops and actually increase acres. There are appropriate constraints that treat annual and perennial (e.g. orchards, vineyards) differently. Almonds, which accounted for 15% of total ag revenue in 2010 (in Stanislaus County), are scarcely affected by changes in ag water deliveries. Rice, pasture, and field crops (e.g. beans and alfalfa) are the most affected; they accounted for 9% of total revenue (in 2011).

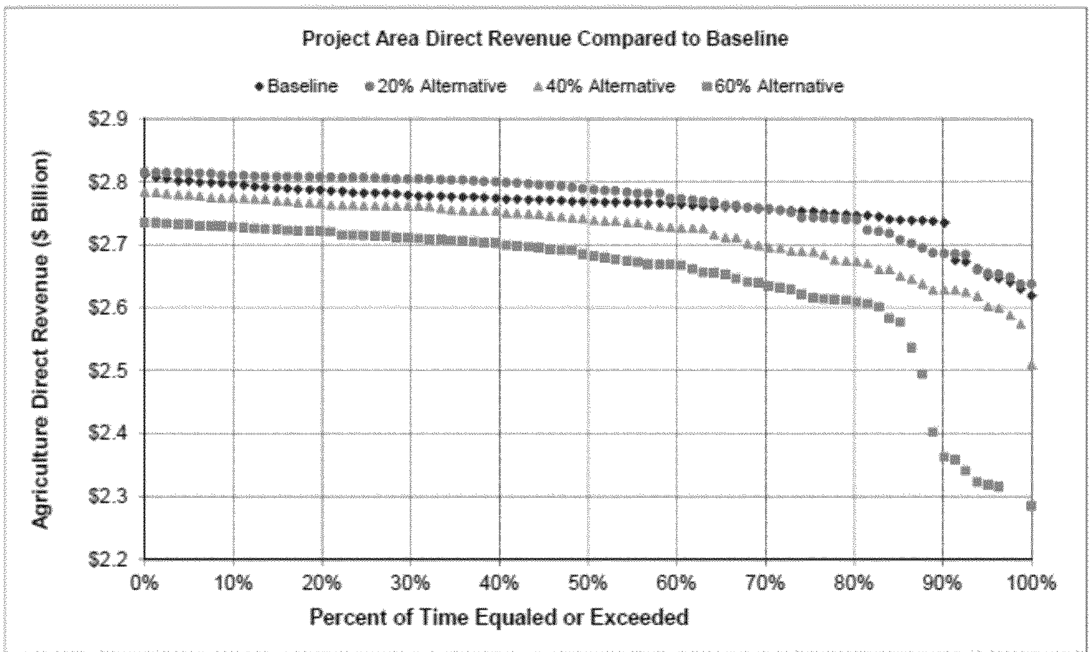


Figure G-10. Exceedance Plot of SWAP Estimates for Total LSJR Watershed Annual Agricultural Revenues for the LSJR Alternatives and the Baseline Across the 82 Years of Simulation

The figure above shows that, most of the time, annual ag revenues would drop from a baseline of $2.75 to $2.80 billion, to about $30 to $100 million less. In the driest years, revenue would fall $100 to $330 million relative to baseline, depending on the stream flow alternative. This would be about 4% to 12% of ag revenues. Under the 40% of unimpaired flow alternative, ag revenue would decline less than 2% 70% of the time. If adjustments to the fixed percentage approach were made during dry years, these marginal declines would extend a greater percentage of the time.

To put a 2% decline into perspective, ag revenues, which are affected by commodity prices as well as water supply, weather, and other factors, typically vary about 6% per year, up and down, in Stanislaus County. Between 2000 and 2010, *annual variation* in total ag revenue ranged from a 6% decrease to a 32% increase. Individual variation among different crops was far greater than this. On the whole, total ag revenues increased 70% during the period in Stanislaus County and 40% in Merced County (even adjusting to constant dollars).

STEP 3: REGIONAL ECONOMY

The purpose of this section is to explore the ripple effects on the regional economy from changes in ag revenue (e.g. the fertilizer company, the farm laborer, and all the items they buy at local businesses, as well as the local sales taxes they pay, etc.). It relies on IMPLAN, a regional economic model notorious for its simplistic assumptions and exaggerated results. For example, the model assumes fixed factors of production and assumes that producers (e.g. farmers) are unable to adjust *in any way* to changing water supply, prices, or other inputs.

The report provides its own caveat on page G-29:

> *Input - output analysis approach employed by IMPLAN usually overestimates indirect job and income losses. One of the fundamental assumptions in input - output analysis is that trading patterns between industries are fixed. This assumption implies that suppliers always cut production and lay off workers in proportion to the amount of product supplied to farms or other industries reducing production. In reality, businesses are always adapting to changing conditions. When a farm cuts back production, some suppliers would be able to make up part of their losses in business by finding new markets in other areas. Growth in other parts of the local economy is expected to provide opportunities for these firms. For these and other reasons, job and income losses estimated using input - output analysis should often be treated as upper limits on the actual losses expected.*

The results are presented both in terms of dollars of economic activity and employment. In general, they add about 75% to the magnitude of the impact. In the 40% of impaired flow scenario, employment declines 4% or less 90% of the time, in the ag and related sectors. Because of the problems with IMPLAN described above, focusing on this model is not warranted; it is most relevant to simply focus on the impacts to ag revenue (in Step 2 above), which can be estimated with much greater confidence.

Conclusion

I believe this report was prepared fairly objectively, with no obvious bias in favor of agriculture or instream flows. That said, there are still some issues with it that should be understood.

There is increasing uncertainty with each successive model, both because they build on each other, and because they increasingly incorporate more moving parts. The water flow model is reasonably objective, although I do not have the experience to evaluate it in detail. The ag production and revenue model is subject to considerable uncertainties, especially since ag can be (and regularly is) subject to significant external factors outside the model. That said, Richard Howitt is probably the most qualified person in the world to construct this model, and he did so with considerable knowledge of the local ag economy in this area. Thus, the ag production and revenue model (SWAP) is probably as accurate as it can be, and likely more accurate than any potentially competing models. The final model, IMPLAN, of the regional economy, is notoriously problematic, as described above.

The following factors that would minimize the effects of instream flow requirements on ag production:

1. The authors admit to using the most conservative assumptions that would produce the maximum economic effects. This is especially true of the IMPLAN model.
2. The economic models present only short-run results. While the draft report does not say this (and gives the impression of this level of impacts in perpetuity), the authors all openly admit the results of their model are only applicable in the short run. In the long run (which could be as short as five years), farmers adapt, employ new technologies, and shift crops in ways that dampen the impacts described in the model.
3. A flow regime may be constructed to be more creative than the straight percentage reductions modeled here, which could decrease (or increase) the effects. This would likely be a function of how the flow regime is modified in dry years (e.g. is it 40% in most years, but more or less in dry years?).
4. Because increased groundwater pumping is widely anticipated, most of the ag production and revenue impacts described would simply not happen, especially in the short run. In the long run, overdrafting of groundwater would cause similar problems, but would be somewhat mitigated by the long-run adaptations described in #2 above. A report on the effects on groundwater use combined with ag production would perhaps be more realistic and informative.
5. Changes in the flood control requirements could have a significant effect on the water available for ag deliveries. This is not explored in these reports.

The take-home message is this: Under the intermediate scenario (40% of unimpaired flows; the green triangles below), *total ag revenue will decrease less than 2% (~$50 million)* most of the time (see Table G-13). This is in the context of annual variation of 6% per year (plus or minus) and an overall growth in ag revenues of 70% over the last decade.

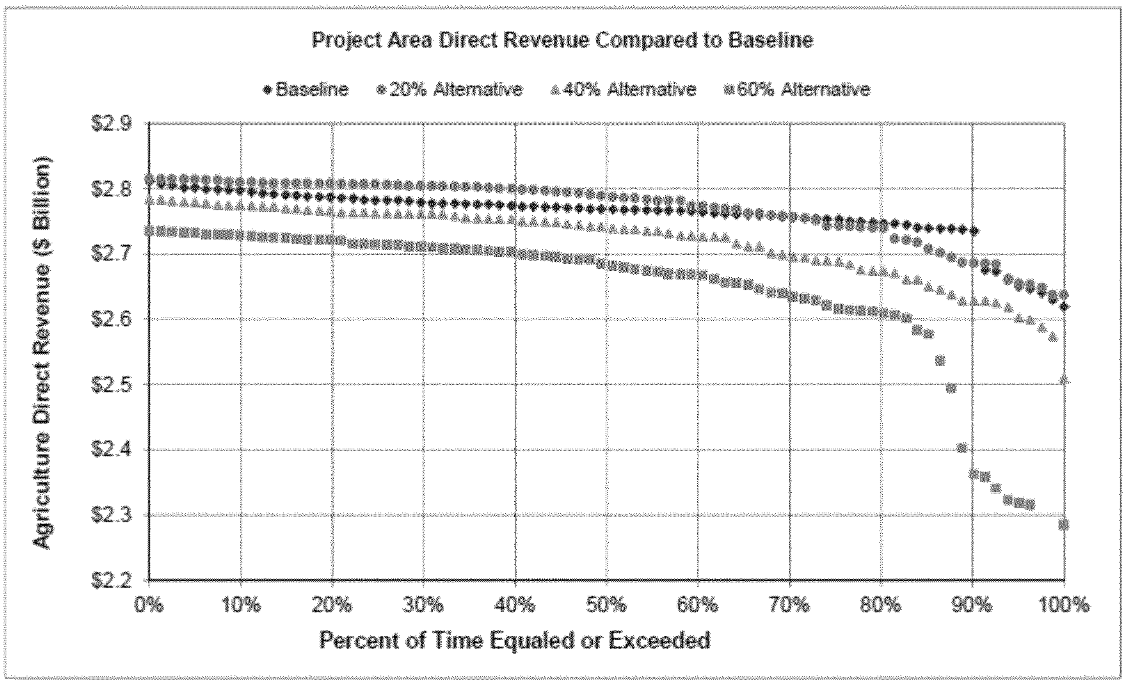


Figure G-10. Exceedance Plot of SWAP Estimates for Total LSJR Watershed Annual Agricultural Revenues for the LSJR Alternatives and the Baseline Across the 82 Years of Simulation

An important additional note is this: Most of the impacts happen in the short run, and the impacts are worse in dry years (the right-hand side of the graph). Thus, *the primary focus of concern should be on the possibility of dry years in the short run* (e.g., in the first few years of the new flow regime). A flow regime that includes provisions to protect agriculture in the event of dry years during the first five years may mitigate a large portion of the effects described in this report.